# Bradycardia and tachycardia occurring in older people: investigations and management

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**Abstract**

**In the elderly, the investigation of symptoms potentially due to an arrhythmic cause is similar to that for a younger person. In many cases, however, a history obtained from a friend or relative can be valuable. Routine investigations should include tests of thyroid function, an electrocardiogram (ECG), and ambulatory ECG recording. In patients without cerebrovascular disease, carotid sinus massage with continuous ECG monitoring should be performed.**

**The role of device therapy in the management of arrhythmias in patients of all ages is increasing. Permanent pacing can improve symptoms and prognosis in patients with certain bradycardia, and the indications for pacing are available in contemporary international guidelines. Recent developments in device therapy include multisite pacing and implantable cardioverter defibrillators. Emerging data suggest that these devices can be used to good effect in selected elderly patients.**

**Key words:** arrhythmia, elderly, pacemaker, implantable cardioverter defibrillator.

*Br J Cardiol* 2004;**11**:224–8



## Introduction

In the last article in this series, we discussed the epidemiology and clinical features of bradycardias and tachycardias[1] in older people. Altered cardiac conduction and symptomatic arrhythmia are more likely to be experienced by the elderly due to age-related changes within the heart, an increased likelihood of co-morbid health problems, and a reduced tolerance of anti-arrhythmic drug therapy.

In this article, we review the investigations for, and management of, bradycardias and tachycardias, with particular emphasis on device therapy. In light of the recent expanded indications for implantable cardioverter defibrillators (ICDs), consideration will also be given to the issues surrounding the management of elderly patients at high risk of malignant ventricular arrhythmias and sudden cardiac death.

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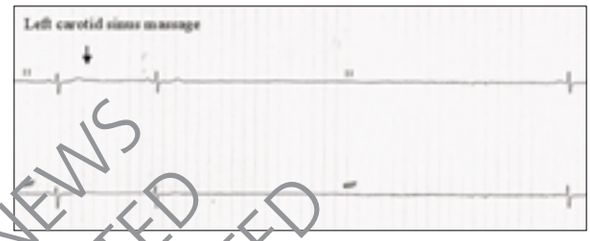
**Figure 1.** Electrocardiogram showing asystole occurring with left carotid sinus massage




## Investigations

A causal relationship between symptoms and an abnormal heart rate or rhythm must be established *a priori* in order to guide management. A resting 12-lead electrocardiogram (ECG) is a first-line investigation in any patient with symptoms that are potentially due to an arrhythmia.

Carotid sinus massage should be done with the patient supine using ECG and blood pressure monitoring. The ECG recording should be printed.[2] The duration of massage should be 15–40 seconds, with the manoeuvre repeated on the contra-lateral side no less than 15 seconds later. Carotid sinus syncope is diagnosed with the induction of symptoms in those with carotid sinus hypersensitivity (figure 1). Carotid sinus massage is not without risk, and should not be performed in those with cerebro-/carotid vascular disease because of the risk of carotid emboli. Vagal manoeuvres, or intravenous adenosine, with continuous ECG recording, should be used for the diagnosis of tachyarrhythmias (figure 2).

An ambulatory 24-hour ECG, or a cardiac monitor which can record for a longer period of time, are also useful. In the very elderly, an ambulatory 24-hour ECG may detect arrhythmias indicative of an adverse prognosis (figure 3).[3] In this prospective study of 423 ambulant, elderly persons aged 75–85 years, it was found that non-sustained ventricular tachycardia (VT) occurred in 5% of subjects and was an independent predictor (relative risk approximately three-fold) of death or myocardial infarction. Sinus bradycardia or atrioventricular (AV) block was detected in 13% and 4% of patients, respectively.

**Figure 2.** Electrocardiogram showing atrial flutter with 1:1 atrioventricular conduction. Intravenous adenosine (6 mg) was administered resulting in transient block of atrioventricular conduction. At this point, the electrogram reveals atrial flutter waves with a rate of 300 per minute

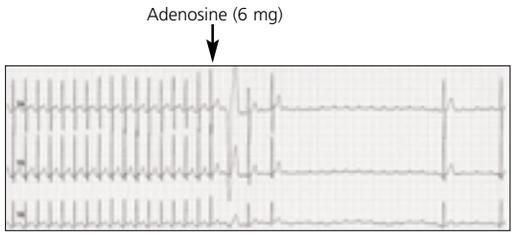



**Figure 3.** Ambulatory monitoring recording of sustained ventricular tachycardia, terminated by anti-tachycardia pacing from an implantable cardioverter defibrillator, with restoration of sinus rhythm

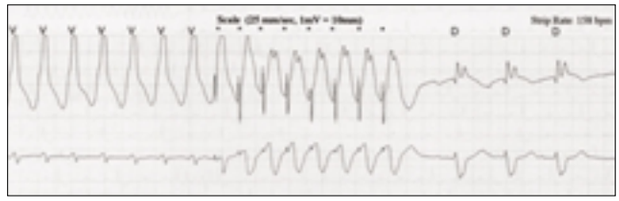


**Table 1.** The North American Society of Pacing and Electrophysiology and British Pacing and Electrophysiology Group Pacemaker code[5]

| I<br>Chamber(s) paced | II<br>Chamber(s) sensed | III<br>Response to sensing | IV *<br>Programmability, rate and modulation | V<br>Antitachyarrhythmia function(s) |
|---|---|---|---|---|
| O = none | O = none | O = none | O = none | O = none |
| A = atrium | A = atrium | T = triggered | P = simple programmable | P = pacing |
| V = ventricle | V = ventricle | I = inhibited | M = multiprogrammable | S = shock |
| D = dual (A+V) | D = dual (A+V) | D = dual (T + I) | C = communicating | D = dual (P+S) |
| | | | R = rate modulation | |

**Key:** * Pacemakers currently used are multiprogrammable and communicating, whereas rate modulation (R) is an additional feature in selected devices



Both of these bradyarrhythmias were independent predictors of stroke during follow-up. A signal-averaged ECG, which may reveal abnormal, high frequency late potentials in the QRS segment, may also be a useful screening test to determine a person's risk for arrhythmic death.

## Management of bradycardias

Sinus bradycardia and 1st degree heart block are generally not associated with an adverse prognosis and will not be discussed further. Precipitant causes for bradycardia and high-grade (2nd degree and complete) heart block should be excluded. These include concomitant therapy with rate-limiting drugs, such as beta blockers, digoxin, diltiazem and verapamil, and systemic problems, such as hypothyroidism and hypothermia.

### Pacemakers

The first permanent pacemaker (PPM) was implanted in 1958 and now approximately 500,000 devices are implanted every year. The terminology used to describe pacemakers applies to the chamber paced, the chamber sensed, the response to sensing, the programmable capability, and anti-tachycardia functions (table 1).[6] Guidelines are now available on the indications for permanent pacing.[5,6] In general, pacing in sino-atrial disease is indicated to improve symptoms and functional status, whereas pacing for AV block is for prognostic reasons. The lifespan of a pacemaker is approximately seven to 12 years for a single chamber and five to 10 years for a dual chamber device, depending on how much it is used.

### Recent developments in pacing

*UK PACE:* This was a multi-centre randomised trial of single versus dual chamber pacing in patients with complete AV block. The five-year follow-up data were reported at the American College of Cardiology Annual Conference (Chicago, USA, 29th March – 2nd April 2003). Long-term prognosis is similar with either single or dual (VVI or DDD) pacing.

*Multi-site pacing:* Cardiac resynchronisation therapy with multi-site (biventricular) pacing may improve symptoms in heart failure patients with moderate-severe functional curtailment (New York Heart Association class III-IV), QRS prolongation (> 150 ms) and dyssynchronous ventricular contraction. This therapy is therefore not indicated for bradycardia but rather is designed to improve myocardial performance in a subset of patients with heart failure. This technique is costly and is still being developed in most heart failure services. The potential benefits of multi-site pacing in elderly patients with ventricular electromechanical dissociation are uncertain.

## Management of supraventricular arrhythmias

Precipitant, reversible causes for supraventricular arrhythmias

**Table 2.** Selected drugs that are used in the treatment of arrhythmias in the elderly

| Drug | Class<br>Mechanism of action | Indication | Comment/caution |
|---|---|---|---|
| Lignocaine | Ia. Sodium channel blocker | Treatment of VT/ VF | Use according to ALS guidelines.<br>Negative inotropic effect |
| Flecainide | Ic. Sodium channel blocker | Prevention and cardioversion of SVT - AF; AVRT, AVNRT | Can be effective and is reasonably well tolerated. Caution in those with coronary heart disease and/or heart failure |
| Beta blockers:<br>non-β1 selective: propranolol<br>β1-selective: atenolol, bisoprolol, metoprolol, | II. Anti-sympathetic nervous system | Symptomatic tachycardias, especially AF, and SVT (AVRT, AVNRT) | May cause lethargy or postural hypotension |
| Amiodarone | III. Prolongation of action potential duration | Prevention and cardioversion of atrial and ventricular arrhythmias | Wide side-effect profile<br>Chronic therapy: monitor TFTs/LFTs at 6–12 month intervals. Consider baseline PFTs and 6–12 month monitoring |
| Sotalol | II and III. Prolongation of action potential duration.<br>Non-selective beta blocker | Prevention and cardioversion of atrial and ventricular arrhythmias | Can be effective and is reasonably well tolerated. Caution in those with heart failure and ischaemic heart disease |
| Verapamil | IV. Slow calcium channel antagonist (AV node blocker) | Supraventricular tachyarrhythmias<br>- prophylaxis for SVT<br>- rate control of AF | Can be effective<br>Avoid in heart failure<br>May cause constipation |
| Digoxin | Slows AV node conduction | AF | In AF, less effective control of heart rate, particularly during exercise, than beta blockers. Reasonably well tolerated. Caution in renal dysfunction |

**Key:** VT = ventricular tachycardia; VF = ventricular fibrillation; SVT = supraventricular tachycardia; AVRT = atrioventricular re-entrant tachycardia; AVNRT = atrioventricular node re-entrant tachycardia; AF = atrial fibrillation; ALS = advanced life support; TFT = thyroid function tests; LFT = liver function tests; PFT = pulmonary function test



should be identified and corrected. These include alcohol excess, electrolyte disturbance and thyroid disorders.

Most narrow complex tachycardias are benign and – if symptomatic and sustained – respond to beta blockers or verapamil. Drug therapy prescribed to prevent the recurrence of a supraventricular tachycardia (SVT) should be chosen with the nature of the rhythm problem in mind (table 2). For example, verapamil can be very useful for the prevention of paroxysmal junctional tachycardia. Elderly patients are more prone to experience the side effects of anti-arrhythmic drugs, which should be prescribed with caution (see table 2).

Ambulant elderly patients who are diagnosed with Wolff-Parkinson-White syndrome should, in general, undergo similar management to younger patients.[7,8] Electrophysiological studies (EPS) and radiofrequency ablation therapy can be of value in selected elderly patients.[9] For example, a patient who has a good quality of life – despite advancing years – but who suffers palpitations that are not controlled by medical therapy, should be considered for invasive management.

## Management of ventricular arrhythmias

### Pharmacological therapy (table 2)

Beta blockers are effective treatments for the prevention of ventricular arrhythmias, particularly in the setting of secondary prevention therapy post-myocardial infarction, where they are often underused in the elderly.[10] In the Cardiac-Suppression Arrhythmia Trial (CAST),[11] the Class Ic agents, flecainide and encainide, compared with placebo, increased the risk of death in patients who had asymptomatic ventricular arrhythmias after a myocardial infarction. This effect was independent of age. Amiodarone, though less well tolerated in the elderly, improved prognosis to a greater extent in high-risk, elderly patients post-myocardial infarction or in those who had heart failure.[12] The decision to treat, or prevent, ventricular arrhythmias should be considered carefully and should usually be made in conjunction with a cardiologist. Amiodarone may be used as empirical therapy for VT in elderly patients, or an ICD may be considered in those with a reasonable quality of life and prognosis.

### Device therapy

ICDs for VT and/or ventricular fibrillation (VF) are devices which can detect abnormal ventricular rates and terminate these arrhythmias according to programmed algorithms. The ICD has a pacemaker capability which is activated when ventricular rates occur that are lower, or higher, than the programmed rate limits of the device. The ICD can therefore function as a con-

**Figure 4.** Retrieved implantable cardioverter defibrillator (ICD) electrograms showing successful termination of a spontaneous episode of ventricular fibrillation by a 31 Joule shock. **a**: shows signals from right ventricular sensing lead and **b**: shows filtered electrogram from the shock circuit

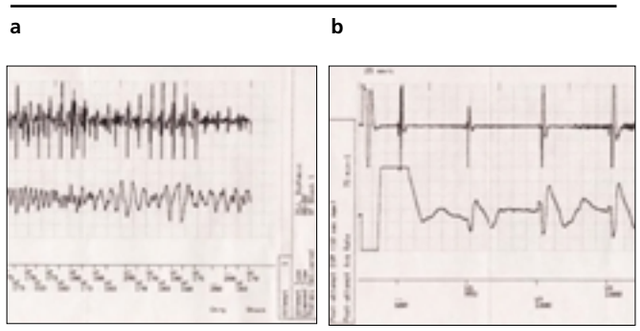



**Table 3.** Guidelines for implantation of ICDs according to the National Institute for Clinical Excellence (see also http://www.nice.org.uk/pdf/Defibrillators_A4_summary.pdf). These indications can be considered in elderly patients, although familial cardiac conditions are unlikely to be applicable

| | |
|---|---|
| **Primary prevention** | A) A history of MI and the following:<br>- Non-sustained VT on a 24 hr ECG monitor<br>- Inducible VT on EP testing<br>- LVEF < 35%, NYHA Class I-III<br>B) A familial cardiac condition with a high risk of sudden cardiac death, including long QT syndrome, HOCM, Brugada syndrome, ARVD, repaired Tetralogy of Fallot |
| **Secondary prevention** | A) Cardiac arrest due to VT or VF<br>B) Spontaneous or sustained VT causing syncope or significant haemodynamic compromise<br>C) Sustained VT without syncope/cardiac arrest and LVEF < 35%, NYHA Class I-III |

**Key:** MI = myocardial infarction; ECG = electrocardiogram; VT = ventricular tachycardia; EP = electrophysiological; LVEF = left ventricular ejection fraction; NYHA = New York Heart Association; HOCM = hypertrophic obstructive cardiomyopathy; ARVD = arrhythmogenic right ventricular dysplasia; VF = ventricular fibrillation

ventional pacemaker for abnormally slow heart rates. Alternatively, the ICD can terminate abnormal, fast ventricular rates by acting as an 'overdrive' pacemaker, which is known as 'anti-tachycardia pacing' (figure 3). In this case, if repeated bursts of overdrive pacing fail to cardiovert VT, then an electrical shock will be administered. If a tachyarrhythmia is detected, which is registered within the VF zone, then electrical defibrillation therapy should be delivered (figure 4). There are now UK guidelines for the use of ICDs (http://www.nice.org.uk/pdf/Defibrillators_A4_summary.pdf; table 3). Although some of the indications are not applicable to elderly patients, these guidelines are important for clinicians who are involved in their care.

**Key messages**

- In the older patient, investigation of symptoms potentially due to an arrhythmia should be similar to that for a younger person
- Routine investigations should include tests of thyroid function, an electrocardiogram (ECG) and an ambulatory ECG recording. In patients without cerebrovascular disease, carotid sinus massage with continuous ECG monitoring should be performed
- Device therapy is increasingly important in the management of arrhythmias in patients of all ages
- Multi-site pacing and implantable cardioverter defibrillator therapy can be beneficial in selected elderly patients

ICDs improve life expectancy in patients with left ventricular systolic dysfunction (ejection fraction < 35%) post-myocardial infarction.[13] This effect is independent of age. These devices can be effective, and well tolerated in elderly subjects.[14,15] A recent substudy of 204 elderly patients (age > 75 years) who were randomised in the Multicenter Automatic Defibrillator Implantation Trial-II (MADIT II) demonstrated that total mortality was 46% less in the patients who received ICD therapy (n=128), compared to those who received conventional therapy. This mortality benefit was comparable to that evident in younger patients (age < 75 years, mortality benefit 32%).[16]

The median life expectancy of a healthy 80-year-old person is approximately an additional seven years – this figure will be substantially less in a patient of this age who has heart failure. The substantial cost of an ICD implant (£10,000–£15,000) often raises the question of whether or not its use is an inappropriate use of healthcare resources in an elderly patient, particularly when prognosis and quality of life are limited. One alternative is anti-arrhythmic drug therapy with amiodarone which, although cheaper and non-invasive, is a less effective alternative.

Clinicians may also be faced with the decision of whether or not to disable an indwelling ICD, when an elderly patient may be dying from incurable disease. These decisions must be tailored to each individual and involve the patient, his/her relatives, a cardiologist and a care of the elderly physician.

## Conclusion

Arrhythmias can be a debilitating problem in older people. A causal relationship must be established between symptoms and the presence of an underlying arrhythmia. Elderly patients can benefit symptomatically and prognostically from drug therapies for ventricular arrhythmias. Furthermore, elderly patients should

be considered for ICDs where there is an indication but the ultimate decision must be tailored to each individual.

## Editors' note

This is the seventh article in our clinical cardiology series. Previous articles include: the future of cardiology – heart disease in older patients (*Br J Cardiol* 2003;**10**:45-8); heart disease in older patients – myocardial infarction (*Br J Cardiol* 2003;**10**:123-7); thrombolytic therapy for acute ischaemic stroke (*Br J Cardiol* 2003;**10**:197-205); percutaneous coronary intervention in the elderly (*Br J Cardiol* 2003;**10**:293-6); atrial fibrillation in the elderly (*Br J Cardiol* 2003;**10**:373-8), and bradycardia and tachycardia occurring in older people – an introduction (*Br J Cardiol* 2004; **11**:61-4).

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